

WHAT IS CLAIMED IS:

1. A semiconductor device having a multilayer structure, comprising:

at least two wiring layers; and

5 a via contact formed between the at least two layers and made of a metal wiring material which is the same as that of the at least two wiring layers,

wherein the metal wiring material of the via contact contains an additive which is not contained in the metal wiring materials of the at least two wiring layers.

2. The semiconductor device according to claim 1, wherein the metal wiring material is Cu and the additive is one of Sn, Rh, Zn, Al, Ru, Cr, Pd, In, Mg, Co, Zr, Ti, Ag, Ir, Ni, Ge, Nb, B, and Hf.

3. The semiconductor device according to claim 1, wherein the metal wiring material is Al and the additive is Cu or Si.

4. The semiconductor device according to claim 1, wherein the metal wiring material is Ag and the additive is Cu.

5. A semiconductor device having a multilayer structure, comprising:

at least two wiring layers; and

25 a via contact formed between the at least two layers and made of a metal wiring material which is the same as that of the at least two wiring layers,

wherein metal wiring materials of the at least two wiring layers contain at least one additive, and

a metal wiring material of the via contact contains at least two additives which include an additive which is the same as that contained in the metal wiring materials of the at least two wiring layers.

6. The semiconductor device according to claim 5, wherein the metal wiring material is Cu and the at least one additive is one of Sn, Rh, Zn, Al, Ru, Cr, Pd, In, Mg, Co, Zr, Ti, Ag, Ir, Ni, Ge, Nb, B, and Hf.

7. A semiconductor device having a multilayer structure, comprising:

at least two wiring layers; and
a via contact formed between the at least two layers and made of a metal wiring material which is the same as that of the at least two wiring layers,

wherein metal wiring materials of the at least two wiring layers and a metal wiring material of the via contact contain the same additive, and

a concentration of the same additive in metal wiring material of the via contact is higher than that of the same additive in the metal wiring materials of the at least two wiring layers.

8. The semiconductor device according to claim 7, wherein the metal wiring material is Cu and the at least one additive is one of Sn, Rh, Zn, Al, Ru, Cr,

Pd, In, Mg, Co, Zr, Ti, Ag, Ir, Ni, Ge, Nb, B, and Hf.

9. A semiconductor device having a multilayer structure, comprising:

at least two wiring layers; and

5 a via contact formed between the at least two layers and made of a metal wiring material which is the same as that of the at least two wiring layers,

wherein metal wiring materials of the at least two wiring layers contain at least one additive, and

10 a metal wiring material of the via contact contains at least two additives which include an additive which is the same as that contained in the metal wiring materials of the at least two wiring layers, and

15 a concentration of the at least one additive commonly contained in the metal wiring materials of the at least two wiring layers and the metal wiring material of the via contact is higher in the metal wiring material of the via contact than in the metal wiring materials of the at least two wiring layers.

20 10. The semiconductor device according to claim 9, wherein the metal wiring material is Cu and the at least one additive commonly contained is one of Sn, Rh, Zn, Al, Ru, Cr, Pd, In, Mg, Co, Zr, Ti, Ag, Ir, Ni, Ge, Nb, B, and Hf.

11. A semiconductor device comprising:

a first metal wiring layer made of a first wiring

material, formed in a first wiring groove formed in
a first insulating film on a semiconductor substrate;

a second insulating film on the first insulating
film having the first wiring layer embedded therein;

5 a via contact embedded in a via hole formed in the
second insulating film, the via contact being made of
the same wiring material as the first wiring material,
which contain an additive which is not contained in the
first wiring material of the first wiring layer;

10 a third insulating film on the second insulating
film having the via contact formed therein; and

a second metal wiring layer embedded in a second
wiring groove formed in the third insulating film, the
second metal wiring layer being made of the same metal
15 wiring material as the metal wiring material of the
first metal wiring layer.

12. The semiconductor device according to
claim 11, wherein the metal wiring material is Cu and
the additive contained in the metal wiring material is
20 one of Sn, Rh, Zn, Al, Ru, Cr, Pd, In, Mg, Co, Zr, Ti,
Ag, Ir, Ni, Ge, Nb, B, and Hf.

13. A semiconductor device comprising:

a first metal wiring layer made of a first wiring
material added with an additive, formed in a first
25 wiring groove formed in a first insulating film on
a semiconductor substrate;

a second insulating film on the first insulating

film having the first wiring layer embedded therein;

a via contact embedded in a via hole formed in the second insulating film, the via contact being made of the first wiring material which contains the additive;

5 and

a third insulating film on the second insulating film having the via contact formed therein; and

a second metal wiring layer embedded in a second wiring groove formed in the third insulating film, the second metal wiring layer being made of the metal wiring material which contains the additive,

10 wherein a concentration of the additive in the metal wiring material of the via contact is higher than that of the additive in the metal wiring materials of the first metal wiring layer and the second metal wiring layer.

14. The semiconductor device according to claim 13, wherein the metal wiring material is Cu and the additive is one of Sn, Rh, Zn, Al, Ru, Cr, Pd, In, Mg, Co, Zr, Ti, Ag, Ir, Ni, Ge, Nb, B, and Hf.

15 15. A method of manufacturing a semiconductor device, comprising:

forming a first wiring layer made of a metal wiring material in a first wiring groove formed in a first insulating film on a semiconductor substrate;

25 forming a second insulating film on the first insulating film having the first wiring layer formed

therein;

forming a via hole in the second insulating film;

forming a first barrier metal over the surface of
the second insulating film including the via hole;

5 forming a first metal film formed of the metal
wiring material over the surface of the first barrier
metal to embed the metal wiring material in the via
hole;

forming a via contact formed of the first metal
10 film and first barrier metal on the via hole by
removing the first metal film and first barrier metal
from portions other than the inside of the via hole;

forming a third insulating film over the surface
of the second insulating film having the via contact
15 formed thereon;

forming a second wiring groove in the third
insulating film;

forming a second barrier metal over the surface of
the third insulating film including the second wiring
20 groove;

forming a second metal film formed from the first
metal material over the surface of the second barrier
metal; and

forming a second wiring layer formed by residual
25 portions of the second metal film and second barrier
metal in the second wiring groove by removing the
portions of the second metal film and second barrier

metal deposited on the third insulating film,

wherein the metal wiring material of the first metal film contains an additive which is not contained in the metal wiring materials of the first wiring layer and the second metal film.

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16. A method of manufacturing a semiconductor device, comprising:

forming a first wiring layer made of a metal wiring material added with an additive in a first wiring groove formed in a first insulating film on a semiconductor substrate;

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forming a second insulating film on the first insulating film having the first wiring layer formed therein;

15

forming a via hole in the second insulating film; forming a first barrier metal over the second insulating film including the via hole;

forming a first metal film made of the metal wiring material added with the additive over the first barrier metal to embed the via hole with the metal wiring material added with the additive;

20

removing the first metal film and the first barrier metal from portions other than the inside of the via hole to form a via contact formed of the first metal film added with the additive in the via hole;

25

forming a third insulating film over the surface of the second insulating film having the via contact

formed thereon;

forming a second wiring groove in the third insulating film;

forming a second barrier metal over the third insulating film including the second wiring groove;

forming a second metal film made of the metal wiring material added with the additive over the second barrier metal; and

removing the portions of the second metal film and second barrier metal on the third insulating film to form a second wiring layer formed of the second metal film added with the additive in the second wiring groove,

wherein a concentration of the additive in the metal wiring material of the first metal film of the via contact is higher than that of the additive in the metal wiring material of the first wiring layer and the metal wiring material of the second metal film.

17. A method of manufacturing a semiconductor device, comprising:

forming a first wiring layer made of a metal wiring material in a first wiring groove formed in a first insulating film on a semiconductor substrate;

forming a second insulating film on the first insulating film having the first wiring layer formed therein;

forming a via hole in the second insulating film;

forming a first barrier metal over the second insulating film including the via hole;

forming a first metal film made of the metal wiring material over the first barrier metal to embed
5 the via hole with the metal wiring material added with the additive;

removing the first metal film and the first barrier metal from portions other than the inside of the via hole to form a via contact formed of the first
10 metal film in the via hole;

forming a third insulating film over the surface of the second insulating film having the via contact formed thereon;

forming a second wiring groove in the third insulating film;
15

forming a second barrier metal over the third insulating film including the second wiring groove;

forming a second metal film made of the metal wiring material over the second barrier metal; and

20 removing the portions of the second metal film and second barrier metal on the third insulating film to form a second wiring layer formed of the second metal film in the second wiring groove,

wherein metal wiring materials of the first wiring
25 layer and the second wiring layer contain at least one additive, and

the metal wiring material of the first metal film

contains at least two additives which include the at least one additive.

18. A method of manufacturing a semiconductor device, comprising:

- 5 forming a first wiring layer made of a metal wiring material in a first wiring groove formed in a first insulating film on a semiconductor substrate;
- forming a second insulating film on the first insulating film having the first wiring layer formed
- 10 therein;
- forming a via hole in the second insulating film;
- forming a first barrier metal over the second insulating film including the via hole;
- forming a first metal film made of the metal
- 15 wiring material over the first barrier metal to embed the via hole with the metal wiring material;
- removing the first metal film and the first barrier metal from portions other than the inside of the via hole to form a via contact formed of the first
- 20 metal film in the via hole;
- forming a third insulating film over the surface of the second insulating film having the via contact formed thereon;
- forming a second wiring groove in the third
- 25 insulating film;
- forming a second barrier metal over the third insulating film including the second wiring groove;

forming a second metal film made of the metal wiring material over the second barrier metal to embed the second wiring groove with the metal wiring material; and

5 removing the portions of the second metal film and second barrier metal on the third insulating film to form a second wiring layer formed of the second metal wiring layer in the second wiring groove,

 wherein metal wiring materials of the first wiring
10 layer and the second wiring layer contain at least one additive, and

 the metal wiring material of the first metal film contains at least two additives which include the at least one additive.

15 wherein a concentration of the at least one additive in the metal wiring material of the first metal film is higher than that of the at least one additive in the metal wiring material of the first wiring layer and the metal wiring material of the
20 second metal film.

19. A method of manufacturing a semiconductor device, comprising:

 forming a first wiring layer made of a metal wiring material in a first wiring groove formed in
25 a first insulating film on a semiconductor substrate;

 forming a second insulating film on the first insulating film having the first wiring layer formed

therein;

forming a via hole in the second insulating film;

forming a first barrier metal over the second
insulating film including the via hole;

5 forming a first metal film made of the metal
wiring material over the first barrier metal to embed
the via hole with the metal wiring material;

 forming a substance layer containing an additive
which is not contained in the metal wiring material of
10 the first wiring layer over the first metal film;

 heating to diffuse the additive contained in the
substance layer into first metal film;

 removing the substance layer as well as the first
metal film and the first barrier metal from portions
15 other than the inside of the via hole to form a via
contact formed of the first metal film containing the
additive in the via hole;

 forming a third insulating film over the surface
of the second insulating film having the via contact
20 formed thereon;

 forming a second wiring groove in the third
insulating film;

 forming a second barrier metal over the third
insulating film including the second wiring groove;

25 forming a second metal film made of the metal
wiring material over the second barrier metal; and

 removing the portions of the second metal film and

second barrier metal on the third insulating film to form a second wiring layer formed of the second metal film in the second wiring groove.